PATENT ABSTRACTS OF JAPAN

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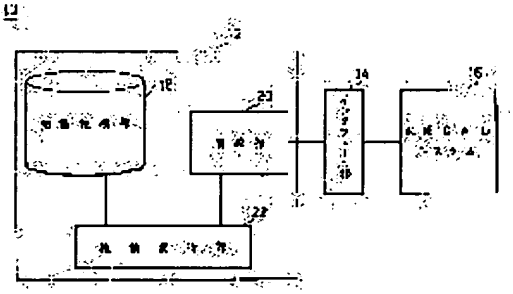
(54) SHAPE CORRECTING METHOD FOR LAYOUT DESIGN SYSTEM

(57)Abstract:

PURPOSE: To most sultably arrange parts in a short time by determining a specific point and inferring the layout in accordance with a simplified shape corrected based on this point.

CONSTITUTION: Data of a simplified shape is taken unto an expert system 12 from a general CAD system 16, and the layout is inferred based on this data. When all simplified shapes are arranged without interference in this manner, actual shapes are arranged in the same manner as simplified shapes in the general CAD system 16; but if interference occurs between actual shapes, a specific point is determined. The segment closest to the specific point out of segments which prescribe simplified shapes is selected, and the selected segment is changed. Thus, the layout is inferred based on data of changed simplified shapes.



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CLAIMS

[Claim(s)]
[Claim 1] In the arrangement design system which designs arrangement of each parts using the data of the simplification configuration which simplified the actual configuration of each parts It is the approach of actually amending the difference between a configuration and a simplification configuration, and is (a). A specifying point is determined and it is (b). The segment nearest to said specifying point is selected among each part which specifies said simplification configuration, and it is (c). The configuration amendment approach of changing said selected segment.
[Claim 2] Said step (a) It is the configuration amendment approach according to claim 1 that said specifying point is decided then based on the distance between parts.
[Claim 3] (d) It is said step (c) with whether said specifying point is in the inside of the closed side of said simplification configuration or it is outside, and the approach of judging and being different according to it. The configuration amendment approach according to claim 1 or 2 to perform.
[Claim 4] said step (d) the case where set and it judges with inside -- said step (c) ** (c-1) The parallel displacement of said selected segment is carried out to said specifying point (c-2). The configuration amendment approach according to claim 3 of changing said simplification configuration by the segment which carried out the parallel displacement.
[Claim 5] Said step (d) When it sets and judges with outside, it is said step (c). The configuration amendment approach according to claim 3 or 4 which forms the lobe which projects the point specifying (c-11) from the segment of said simplification configuration nearest to a passage and said specifying point.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the approach of actually amending the difference between a configuration and a simplification configuration about the configuration amendment approach in an arrangement design system in the new arrangement design system which designs arrangement of each parts using the data of the simplification configuration which simplified the actual configuration of each parts especially, for example.
[0002]
[Description of the Prior Art] For example, it is necessary to arrange efficiently to the inside of housing to which a lens, mechanism components, a viewfinder, etc. were restricted by the device as which a miniaturization is required like a 8mm camcorder. For this reason, conventionally, it is for example, two-dimensional CAD (Computer Aided Design). Using the system, it opted for arrangement by a designer's intuition, the existence of interference of each parts was seen after that, and arrangement of each parts and the configuration of housing were amended.
[0003]
[Problem(s) to be Solved by the Invention] However, by such conventional approach, a design was not efficient, and in order to avoid interference of each parts, there was a trouble of taking time amount. Moreover, there was also a trouble that optimal arrangement of each parts was not necessarily carried out. So, the main purpose of this invention is offering the arrangement design system which can carry out optimal arrangement of each parts by short time amount.
[0004] Other purposes of this invention are offering the amendment approach which can amend efficiently the difference of the actual configuration of each parts, and a simplification configuration in such an arrangement design system.
[0005]
[Means for Solving the Problem] In the arrangement design system with which this invention designs arrangement of each parts using the data of the simplification configuration which simplified the actual configuration of each parts It is the approach of actually amending the difference between a configuration and a simplification configuration, and is (a). A specifying point is determined and it is (b). The segment nearest to a specifying point is selected among each part which specifies a simplification configuration, and it is (c). It is the configuration amendment approach of changing the selected segment.
[0006]
[Function] For example, in the arrangement design system which combined the three-dimensional-CAD system and the expert system, the simplification configuration data of each parts are incorporated by the expert system, and optimal arrangement inference is carried out based on this data. If the simplification configuration of all parts is arranged without interference by this, based on this arrangement data, the actual configuration of each parts will

be arranged in a three-dimensional-CAD system by it. When interference actually arises in a configuration at this time, the position in consideration of the distance between parts is made into a specifying point.
[0007] When this specifying point is in the inside of the closed side of the simplification configuration of specific parts, the parallel displacement of the segment nearest to a specifying point is carried out to a specifying point among the segments which specify a simplification configuration, and a simplification configuration is changed by the segment which carried out the parallel displacement. On the other hand, when a specifying point is out of the closed side of the simplification configuration of specific parts, the lobe which projects a specifying point from the component of the simplification configuration nearest to a passage and a specifying point is formed. And based on the data of the changed simplification configuration, arrangement inference is carried out again.
[0008]
[Effect of the Invention] Since arrangement inference is carried out by the simplification configuration of the parts which determined the specifying point and were amended based on this according to this invention, optimal arrangement of each parts can be carried out by short time amount. The above-mentioned purpose of this invention, the other purposes, the description, and an advantage will become still clearer from the detailed explanation of the following examples given with reference to a drawing.
[0009]
[Example] With reference to drawing 1 , the arrangement decision system 10 of this example contains an expert system 12 and general-purpose CAD system 16 connected to the expert system 12 through the interface section 14. An expert system 12 contains the knowledge storage section 18, the function section 20, and the inference activation section 22. The knowledge of the expert about arrangement etc. is stored in the knowledge storage section 18. There are temporary knowledge, such as a constraint and configuration data, universal knowledge of the know-how about arrangement, etc. as knowledge stored in the knowledge storage section 18. Temporary knowledge, such as a constraint and configuration data, is described in a frame format, and the universal knowledge of the know-how about arrangement is described in the Ruhr format.
[0010] The function and arithmetic operation type which process easy graphic forms, such as a rectangular parallelepiped and a cylinder, are described as a function with LISP (LISP) language by the function section 20. The function section 20 performs interference judging between two bodies, calculation of the amount of interference, etc. based on simplification configuration data. The inference activation section 22 performs inference, using the knowledge storage section 18 and the function section 20. As the inference activation section 22, the general-purpose AI tool which used LISP language as the base is used.
[0011] Using a configuration, general-purpose CAD system 16 computes the volume of the existence of interference, and the interference section, and the distance of each part, and actually has three-dimension solid-modeler ability. This general-purpose CAD system 16 is connected to the inference activation section 22 through the function section 20 by the interface section 14 described by the shell script. Next, with reference to drawing 2 , processing actuation of arrangement inference in the arrangement decision system 10 is explained. First, the simplification configuration data with which the expert system 12 actually simplified the configuration from general-purpose CAD system 16 in step S1 are incorporated, and it stores in the knowledge storage section 18. An example of the DS of the simplification configuration data stored in the knowledge storage section 18 is shown in drawing 3 . This DS is a layered structure.
[0012] To a hierarchy's most significant, namely, the data (a goods name, origin/datum coordinate data, etc.) of "parts" In the low order, "the flat-surface configuration in XY flat

surface" concerning [the data of the "parts part" which constitutes parts] each parts part, "the flat-surface configuration in YZ flat surface", and "the flat-surface configuration in ZY flat surface" at the low order The data (coordinate data etc.) of "the constituting point" of each segment are arranged for the data of the "segment" which constitutes each flat-surface configuration in the low order at the low order. And simplification configuration data with such DS are stored in the knowledge storage section 18.

[0013] Next, in step S3, the existence of three-dimension-interference of a simplification configuration is judged by the graphics-processing function of the function section 20. And if it judges that there is interference, the intersection of each segment which specifies the simplification configuration of the parts in which it interferes each other, the distance between segments, etc. will be computed using the function for graphics processing stored in the function section 20, and the simplification configuration data stored in the knowledge storage section 18. An example (function for computing the distance of two segments) of the function for graphics processing used in the function section 20 is shown in drawing 4 .

[0014] Then, the migration direction and movement magnitude required in order that specific parts may avoid interference between other parts in step S7 are determined. Here, when there are two or more migration directions which can avoid interference, the direction of arbitration is determined. However, balance is maintained so that the count of migration in each direction may be counted and a bias may not produce it in the migration direction chosen.

[0015] Then, it judges whether it is the same as the point moved when the point which it is going to move in step S9 was former interference evasion actuation. And when it is "YES", it shifts to step S13 noting that interference is nonavoidable, but when it is "NO", in step S11, a simplification configuration is moved to the point determined in step S7, and interference of a particular part is avoided. Then, it shifts to step S3 and judges whether there is any interference again. And if there is no interference, it will shift to step S13.

[0016] in step S13, interference with the origin/datum data of each parts which are general-purpose CAD systems 16 and were sent from the expert system 12, and which parts and which parts should be checked -- ** -- the actual configuration of parts is arranged in response to a command, and the existence of interference of a configuration is actually judged. That is, configuration data are actually moved to the reference point location, it arranges, and the existence of the three-dimension-interference between the specified parts is seen. Then, in step S15, an expert system 12 actually incorporates the judgment result of the existence of interference of a configuration, and the coordinate data of an interference part, and it judges whether this judgment result and the judgment result about the existence of interference of a simplification configuration are in agreement. And if it is "YES", processing will be ended noting that optimal arrangement of each parts is carried out, or noting that interference is nonavoidable. That is, processing is ended noting that optimal arrangement of each parts will be carried out, if a configuration and a simplification configuration do not actually have interference in which part, and if there is interference in the part into which a configuration and a simplification configuration are actually common, the interference between parts will end processing noting that it is nonavoidable.

[0017] On the other hand, if it is "NO" in step S15, in step S17, an expert system will amend a simplification configuration about the part from which a judgment result differs. That is, there is interference about a simplification configuration, and when there is actually no interference about a configuration, and when there is no interference about a simplification configuration and there is actually interference about a configuration, a simplification configuration is amended about the part. In addition, a judgment result does not amend about the same part. And it shifts to step S3.

[0018] Then, with reference to drawing 5 , the subroutine which amends the simplification configuration of specific parts is explained. First, in step S1, the minimum distance of the

actual configuration of specific parts and the actual configuration of other parts is measured by general-purpose CAD system 16, a specifying point is searched for, and the data about a specifying point are sent to an expert system 12. Next, in step S3, it computes in which part of the simplification configuration of specific parts a specifying point is located with an expert system 12, and distance with the segment which specifies a specifying point and the simplification configuration of specific parts is computed. And the segment from which the distance of a step S5 smell lever serves as the shortest is selected. Then, the equation of a straight line parallel to the segment selected in a passage and step S5 in step S7 in the specifying point is determined, and it judges whether a specifying point is in the inside of the simplification configuration of specific parts in step S9.

[0019] If it is judged as "YES" in step S9, in step S11, the intersection of the segment of the specific neighborhood of a point and an parallel equation will be computed, and the parallel segment which makes the intersection of a step S13 smell lever an endpoint will be determined. Then, in step S15, the segment determined in step S5 is deleted, and the parallel segment determined in step S13 is added in step S17. And in step S19, the coordinate of the endpoint of the segment of the specific neighborhood of a point which is in agreement with the endpoint of the segment determined in step S5 is corrected till the intersection computed in step S11, and processing is ended.

[0020] On the other hand, if it is judged as "NO" in step S9, in step S21, the parallel segment of predetermined die length will be determined using the parallel equation determined in step S7. Then, the perpendicular equation which passes through the endpoint of the parallel segment of a step S23 smell lever is determined, and the intersection of the perpendicular equation of a step S25 smell lever and the segment selected in step S5 is computed. Then, in step S27, the perpendicular segment which connects the endpoint of the parallel segment determined in step S21 and the intersection computed in step S25 is determined, these parallel segments and perpendicular segments are added to the simplification configuration of specific parts in step S29, and processing is ended.

[0021] With reference to drawing 6 and drawing 7 , the actuation at the time of carrying out optimal arrangement of the parts 26a and 28a into parts 24a is explained. In addition, about drawing 6 , parts 24a is omitted on account of explanation. First, if the simplification configurations 24b, 26b, and 28b of Parts 24a, 26a, and 28a are incorporated by the expert system 12 from general-purpose CAD system 16, the existence [configurations / 24b and 26b / simplification configuration 28b and / simplification] of interference will be judged. And if it is judged that interference is nonavoidable in the location shown in drawing 6 (A') and drawing 7 (A'), next, it will set to general-purpose CAD system 16, and the existence of interference between parts 28a and Parts 24a and 26a will be judged. and drawing 6 (A) -- and (A') and drawing 7 (A) -- and (A') -- from -- although there is no interference, since there is interference among the simplification configurations 28b and 26b, among Parts 28a and 26a, simplification configuration 28b is amended noting that an interference existence judging result is not in agreement in this part, so that it may understand.

[0022] That is, the specifying point P1 is searched for from Parts 26a and 28a, and since there is this specifying point P1 inside the segment which specifies simplification configuration 28b, it is amended as simplification configuration 28b shows an expert system 12 to drawing 6 (B') and drawing 7 (B'). then, the existence [configurations / which were amended / simplification configuration 28b and the simplification configurations 24b and 26b] of interference judges -- having -- drawing 6 (C) -- and (C') and drawing 7 (C) -- and (C') parts 28a and simplification configuration 28b are moved so that it may be shown. Since interference was lost about simplification configuration 28b, the existence of the interference about parts 28a to a degree is judged by this. And since the interference existence judging result about both is not in agreement, simplification configuration 28b is amended. That is, the specifying point P2 is

searched for based on Parts 26a and 28a, and since this specifying point P2 is in the outside of the segment which specifies simplification configuration 28b, a lobe is formed as shown in simplification configuration 28b at drawing 6 (D') and drawing 7 (D').
[0023] then, the existence [configurations / which were amended / simplification configuration 28b and the simplification configurations 24b and 26b] of interference judges -- having -- drawing 6 (E) -- and (E') and drawing 7 (E) -- and (E') parts 28a and simplification configuration 28b are moved so that it may be shown. And since interference was lost about both parts 28a and simplification configuration 28b, processing is ended.
[0024] Since arrangement inference is carried out by the simplification configuration of the parts which determined the specifying point and were amended based on this according to this example, optimal arrangement of each parts can be carried out by short time amount. In addition, although the predetermined parallel segment and predetermined perpendicular segment of die length were added in this example when a specifying point was in the outside of the segment which specifies a simplification configuration, as for this invention, it is needless to say that you may make it form the semicircle-like lobe which does not restrict in this case but passes a specifying point.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the electric block diagram showing the arrangement decision structure of a system.
[Drawing 2] It is the flow Fig. showing a part of actuation of the drawing 1 example.
[Drawing 3] It is the mimetic diagram showing the DS of simplification configuration data.
[Drawing 4] It is drawing showing an example of the function for graphics processing of the function section.
[Drawing 5] It is the flow Fig. showing a part of actuation of the drawing 1 example.
[Drawing 6] It is the illustration Fig. showing a part of actuation of the drawing 1 example.
[Drawing 7] It is the illustration Fig. showing a part of actuation of the drawing 1 example.
[Description of Notations]
10 -- Arrangement Decision System
12 -- Expert System
14 -- Interface Section
16 -- CAD Systems in General
18 -- Knowledge Storage Section
20 -- Function Section
22 -- Inference Activation Section

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JAPANESE [JP,07-230492,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS OPERATION EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]